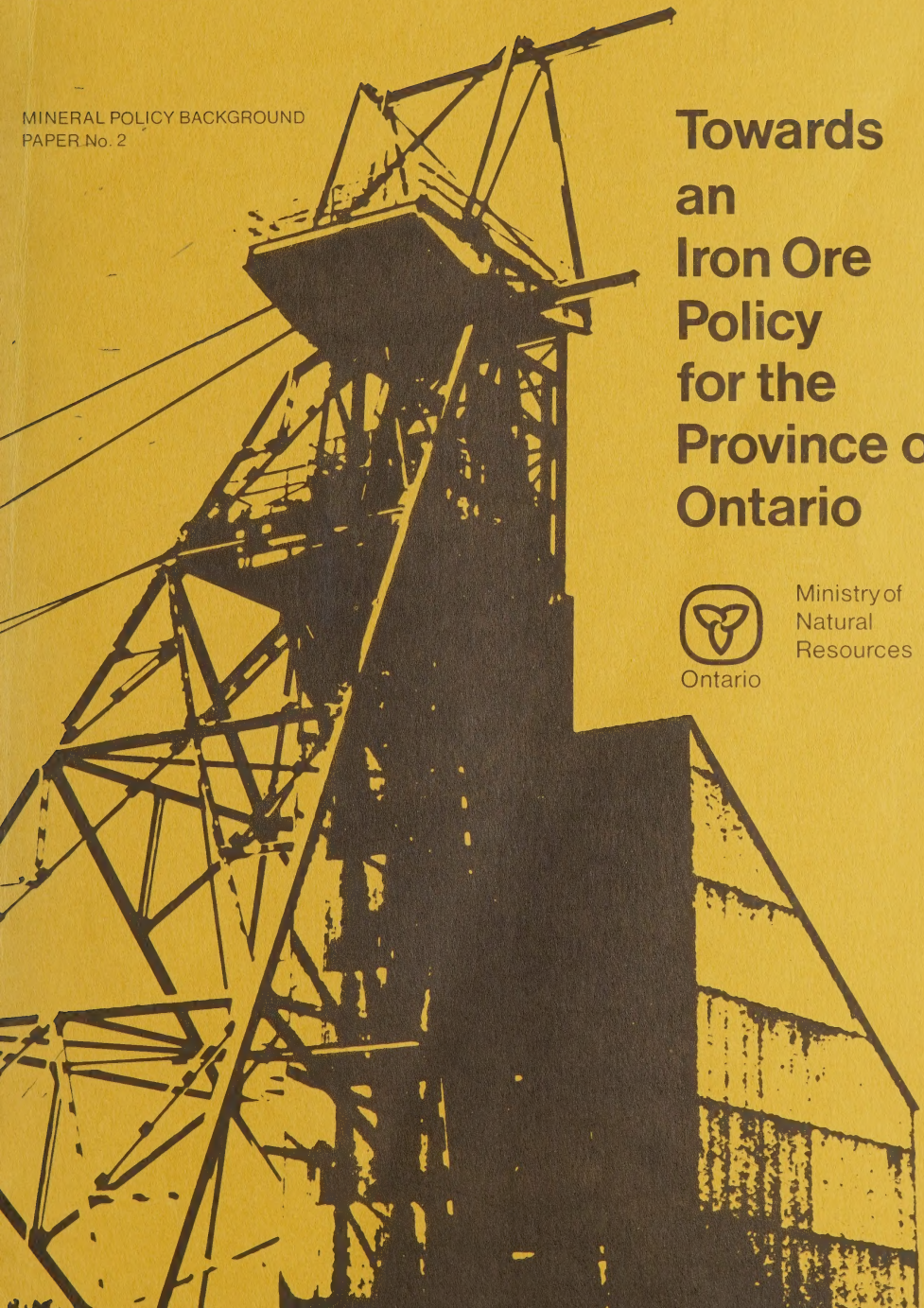
MINERAL POLICY BACKGROUND
PAPER No. 2

Towards an Iron Ore Policy for the Province of Ontario



Ontario
Ministry of Natural Resources

G.A. Jewett, B.A.Sc.,P.Eng., Executive Director
Division of Mines

T.P. Mohide, LLB,J.D. Director, Mineral Resources
and the Mine Assessor

Metallic Minerals Section

E.J. Wade, B.A.Sc.,P.Eng.,M.B.A. Supervisor (Mining, Finance)

G. Anders, Dipl.Ing.,P.Eng.,Ph.D. Policy Analyst (Mining, Economics)

D.H. Bell, B.A.Sc.,P.Eng.,Ph.D Policy Analyst (Metallurgy)

J.W. Birch, B.A.Sc.,P.Eng. Policy Analyst (Mining)

K.S. Rachamalla, B.Eng.,M.Eng., P.Eng.,M.B.A. Policy Analyst (Mining, Finance)

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Ministry of
Natural
Resources

TOWARDS AN IRON ORE POLICY FOR THE PROVINCE OF ONTARIO

BY

Metallic Minerals Section

Mineral Resources Branch

Division of Mines

Mineral Policy Background Paper No. 2

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1. SUMMARY

1.1 The Problem

The following problems currently beset Ontario's iron ore industry:

- Iron ore industry growth is negligible in spite of increased demand for iron and steel products. Major iron ore consumers (Algoma, Dofasco and Stelco) in Ontario continue to rely more and more on ore supplies from outside of the Province to meet their expanding requirements.

- Ontario faces intense competition from the iron ore producers of Quebec-Labrador, the Mesabi and Marquette regions of the U.S., as Ontario's ore deposits are relatively small with lower grade than those of her competitors. This results in higher production costs.

- A delicate balance in estimated expansion and mine closures is projected, in spite of the fact that Ontario's demand for iron ore is expected to outpace the annual supply by 5-6 million tons by 1980.

- Difficulties in meeting the increased demand for iron ore from Ontario production are:

    - large scale operations requiring huge capital investments;

    - increasing the already existing labour shortages in Northern Ontario;

    - the iron ore mining industry recently lost the advantage of mining tax rebates on ore processed in Canada;

    - the effect of Section 113 of the Ontario Mining Act and Ministerial discretion on the iron ore industry's ability to raise adequate financing; and

    - the possibility of construction of iron ore transshipment facilities at Contrecoeur in Quebec. This would permit entry of low priced Brazilian and Venezuelan ores to the Great Lakes and might intensify competition.

1.2 Background

Present known deposits of iron ore are estimated to contain in excess of 2.5 billion tons of extractable material and thus can supply Ontario's needs for over 100 years at present cost levels and with present technology. Any increase of the iron ore price/cost ratio can add as much as another 5.0 billion tons to this figure.

The background information indicates that without any government action or assistance it is very likely that the iron ore industry of Ontario will decline in absolute terms, while iron ore imports to the Province will continue to increase in the future.

Accordingly, if the Government of Ontario wishes to maintain a place for the Province's ore in the current iron ore market, it will be necessary to provide some stimulation to development. It is suggested that freight costs and our close relationship to the market limit the need for such action to:

1. the establishment of clear rules for export which will permit private financing and new development; and

2. the provision of townsite and transportation infrastructure on a user charge basis, where such action is justifiable and supportive to regional or other development programmes of the Government of Ontario.

3. Assurance to participants in major new projects that long-term security of supply safe-guarded by present contractual arrangements will not be jeopardized in the future.

THE IRON ORE INDUSTRY OF ONTARIO

2.1 The Problem in Detail

a) The issues and objectives:

The aims of the Province's iron ore policy are derived from the policy objectives of "A Mineral Policy for Canada."

(i) "Strengthen the contribution of minerals to regional development

(ii) "Realize opportunities for further mineral processing"

(iii) "Improve mineral conservation and use"

(iv) "Increase the return to Canadians from exportable mineral surpluses."

(i) Regional Development

Stimulation of Ontario's iron ore mining industry could lead to the development of under-developed regions in northwestern Ontario. Economically interesting deposits are located at Lake St. Joseph and Geraldton. The extent to which the province invests in infrastructure, particularly transportation facilities and townsites will co-determine the rate, timing and location of iron ore mining developments. Restrictive iron ore policies in Ontario could lead to the development of an iron ore trans-shipping port on the St. Lawrence which would encourage the entry of low cost Brazilian and Venezuelan iron ores to the Great Lakes.

(ii) Further Processing

Almost all iron ore is now shipped as sinter or oxide pellets. However, considerable potential now exists for the growth of the sponge iron markets.

The problem of further processing as applied to iron ores is a complex one. The present interpretation of Section 113 of The Ontario Mining Act, requires processing of the ore through to metallic iron or steel. Foreign investors are reluctant to approve funds when their share of the production may be cut off virtually at any time at the discretion of the Lieutenant-Governor. Export of the

product is approved for only about 5 year periods, renewal of approval being required at the end of the period.

(iii) Improve Conservation and Use of Resources

Ontario's iron ore reserves are large relative to Ontario's demand, but are quite modest compared to reserves in Quebec-Labrador and the Lake Superior region of the U.S. The Ontario deposits are also relatively low-grade. Large capital investment is required to develop such deposits, and competition from developments in Quebec-Labrador (e.g. Fire Lake) and the U.S. (the Tilden Mine) is keen. This has three possible consequences:

- ore reserves developed now could result in depleted reserves, thus driving Canadian iron and steel producers to out-of-province suppliers in the future.

- ore reserves not developed now may become economically viable in the future as competitive sources are mined out, and thus provide a domestic supply of iron ore in the future.

- ore bodies not developed now may remain forever uneconomic, as large high-grade foreign ore bodies are developed and marketed.

This last possibility is a result of the fact that the world contains many large, high-grade iron ore deposits, which will be brought into production with all the advantages of large scale, high grade and modern high-technology transportation and handling facilities. These ores may very well ultimately be more competitive on the lower Great Lakes, and make Ontario's ore bodies uneconomic. A trans-shipping facility on the St. Lawrence capable of handling large capacity ore carriers, would enhance this possibility.

(iv) Increase the Return to Canadians from Exportable Mineral Surpluses

The price of iron ore on the lower Great Lakes is such that the iron ore mining companies operate with very low profit margins, and the mines frequently lose money, or merely break even. With the product priced very nearly

at cost, the result is that the potential profit-earning capacity of the mine is transferred to the purchaser of the iron ore. In the case of Canadian-owned mines, this is not too serious, as the profits are taxed through earnings of the parent company. If the mine's output is purchased by a foreign processor, the potential profit exported with the ore and any government assistance results in benefit to the foreign purchaser. It can be expected then, that tax benefits from iron ore mining operations will be minimal, and taxes, either federal or provincial, will not be paid for many years after the mine has come into production. On that basis however, iron ore imports from mines owned by Ontario steel producers should be encouraged.

Exports are necessary for industry growth however, since Ontario ore consumer's will not have the required additional capacity to absorb the increases in ore production. There is a very real risk in attempting to increase the tax burden on iron ore exports, that foreign consumers will be driven to alternative and less costly sources of supply such as those in Michigan, Minnesota and Quebec-Labrador.

b) The Urgency:

Several developments have reached the point at which decisions have to be made that will be affected by Ontario's iron ore policy:

(i) The Lake St. Joseph Project of Steep Rock Iron Mines

(ii) The effect of Caland Ore Co.'s extended pit operations to 1979 and pellet plant to 1981.

(iii) The decision on the new hospital construction in Atikokan.

c) The Problem and its Relationship to Established Policies and Priorities of the Government:

Two government policies are in conflict, namely Section 113 which discourages development and those that provide for encouragement of regional development.

2.2 Background Information

2.2.1 The Iron Ore Markets

a) The World Markets

World Supply

The iron ore mining industry is scattered throughout the world. However, the major centers of the industry are concentrated in the following regions:

- the Lake Superior districts of the U.S. and Canada;
- the Labrador Trough of Quebec and Newfoundland-Labrador;
- the Minas Gerais area of Brazil;
- the Scandinavian peninsula of Western Europe;
- the Urals and the Ukraine of the U.S.S.R.;
- the mountains of Western Africa;
- the hematite deposits of India; and
- the iron ore fields of Western Australia.

The industry, on a world scale, has grown spectacularly in the last 25 years. It produced about 300 million tons of ore per year in the early 1950's..In 1973, production was 833 million metric tons, an increase of 8.3% over the 1972 production of 752 million metric tons. Figure 1 shows world iron ore movements as of 1972. The capacity of the industry to produce ore of traditional grade and structure has been in excess of demand since about 1960. Present day market specifications are so stringent that almost all iron ore is beneficiated to some degree before it is sold. The minimum treatment for blast furnace feed consists of crushing to minus 4" and screening out the minus $\frac{1}{4}$". Maximum beneficiation includes grinding, concentrating, pelletizing, and induration to produce a strong, sized pellet of specified physical and chemical properties.

The capacity for pellet production has increased constantly. Present world pellet production capacity is estimated at 150 million metric tons per year. A detailed geographic breakdown of the capacity is summarized in Table 1. About 63 million metric tons or 40% of the total capacity is located in the United States, principally in the states of Minnesota and Michigan. Canada has a capacity of 31 million metric tons or 20% of the total, the U.S.S.R. has about 11%

and Australia has about 6.8% with the remaining 22.2% scattered in seventeen different countries.

Additional iron ore pellet capacity presently under construction or planned is estimated at 57.19 million metric tons annually. This would bring world capacity to 213 million metric tons per year by the end of 1976. The greatest part of the additional capacity installations, one-third of the total, would occur in the U.S.S.R., which would then have the second largest capacity in the world, surpassing Canada by 1976. Planned iron ore pellet capacity in the world, is listed in Table 2.

World Demand for Steel

The world's steel industry produced 695.8 million metric tons of raw steel in 1973, a 10% increase over the 1972 production rate of 629.8 million metric tons. The industry faces the prospect of a long period of fast-rising demand for its product.

Steel production is pressing hard against effective capacity in nearly all countries. The effective capacity to produce steel is estimated to be in the order of 750 million metric tons, at the end of 1973.

In order to meet the projected steel demand of 939 million metric tons in 1980, production capacity should grow to approximately 1,050 million metric tons. Steel demand/production of 1,144 million metric tons in 1985 would require a capacity of 1,275 million metric tons by that year. Replacement of old and obsolete production capacity is estimated to require an average of 30 million metric tons per year, or 210 and 150 million metric tons during the periods 1973-1980 and 1980-1985, respectively. Thus, new steel production capacity required to match demand would be 510 million metric tons between 1973 and 1980 and 375 million metric tons between 1980 and 1985, and an overall increase of 885 million metric tons by the end of 1985.

The projected steel consumption up to 1985 is shown in Table 3. These projections are from a study done by the International Iron and Steel Institute (IISI) in 1972. The growth rates associated with these figures are shown in Table 4.

World Iron Ore Reserves

The world consumption of iron ore between the year 1965 and 1980 has been optimistically estimated at less

than 7,000 million tons (of contained iron); the world reserves and resources were estimated in 1968 at 257,400 million tons of ore, ranging from 28% to 66% iron content, representing about 111,700 million tons of contained iron. The iron ore resources of the world are given in Table 5. It is worth noting that other methods of estimating, using different cut-off grades, yield significantly different results, as shown in Table 6.

World Market Summary

World iron ore consumption in 1973 was 858 million metric tons compared to 792 million metric tons in 1972. Iron ore shipments were slightly lower, however, at about 833 million metric tons, due to shipping problems towards the end of the year. World steel production increased by about 10% in 1973, to 695.8 million metric tons.

Between 1950 and 1965 world iron ore markets became much more complex, ultimately resulting in four principal and three subsidiary centres of demand. These are listed in Table 7.

b) U.S. Markets

Table 7 also outlines the four U.S. markets for iron ore. They are relatively isolated from one another due to transportation patterns from the supplying regions. Raw steel production is shown in Table 8.

The lower Great Lakes market is essentially supplied by Great Lakes ores (including Quebec ores) and is largely protected from overseas imported ore by the high cost of transportation from the East Coast. The Eastern Seaboard and Gulf Coast markets are supplied by ocean carriers from Venezuela, Brazil, West Africa and Quebec-Labrador. The west coast market is supplied by local domestic sources as well as imported ore from western Canada.

The U.S. obtained approximately 68% of its iron ore requirements from domestic sources in 1972. (see Table 9) Imported iron ore made up the difference and came principally from the exporting countries shown in Table 10.

Between 1968 and 1972 total U.S. shipments of iron ore declined by 12.5%. Imports from all sources, including Canada, fell by 18.6% during the same period. Table 11 and Figure 2 demonstrate the historical trend of iron ore movements into the U.S. market.

c) Canadian Markets

The Canadian industry shipped 49.0 million metric tons of iron ore in 1973, an increase of about 25% over 1972 shipments. 1974 shipments were substantially the same as those for 1973, largely due to unforeseen interruptions to shipping. Figure 3 shows the iron ore supply data for 1968 to 1972. Canadian production is dominated by the Quebec-Labrador mines followed by Ontario. The production by provinces is given in Table 12, "Canadian Iron Ore Shipments".

The outlook for 1975 is cloudy because of the recessionary adjustments occurring now and the unpredictability of governmental adjustments to them. An industry annual growth rate of 7.5% had been expected until 1980, which would have compared favourably with the 7.2% annual rise in the 1960-1973 period. Domestic shipments had been expected to increase moderately, reflecting a 5.5% domestic steel production annual growth rate and exports had been forecast to grow at an average annual rate of 8.0%. A substantial downward revision of such expectations now would appear to be prudent.

Canadian exports were about 38.5 million metric tons in 1973, up by 30% over 1972 exports of 29.3 million metric tons (see Table 13). Canada's largest customer for iron ore is the U.S. which received 21.5 million metric tons in 1973, about 60% of the exports. Exports to the U.K., Northern Europe, Italy and Japan account for the bulk of the remaining 40%; small amounts are exported to Spain, France, Finland, etc. Exports of Canadian ore, by destination, are shown in Table 14.

An estimated 2.7 million metric tons of iron ore were imported in 1973. This was the first substantial increase in imports since 1964 when imports began a downward trend. Imports are expected to increase to about 3.1 million tons in 1974 when the Tilden Mine in the U.S. starts production. Further increases in imports may be expected when the Oglebay Norton expansion at Eveleth, Minnesota, comes on stream, supplying a total of 1.4 million tons per year to Dofasco and Stelco. Another .55 million tons of pellets a year to Stelco will be supplied after the Hibbing Taconite Co. expansion is completed in 1976. However, the potential closing for up to two years of Reserve Mining Co.'s Silver Bay operations in 76 may put pressures on the Mid-West markets which could reduce imports to Ontario somewhat. The export-import pattern reflects the North-South orientation of shipping activities.

Canadian Iron Ore Resources

The most important Canadian deposits are those of the Quebec-Labrador trough, where there are 20,600 million tons of proven reserves, and a further 32,630 million tons of potential resources of iron ore. Further substantial reserves are located in Ontario, amounting to about 6,500 million tons of proven reserves and potential resources.

Canada can be divided into nine principal regions, or major geological princes:

1. The Appalachian Region
2. The Grenville Pre-Cambrian orogenic belt
3. The Labrador geo-syncline
4 & 5. The Southern part of the Canadian Shield
6. The Northern part of the Canadian Shield
7. The Western Plains Region
8. The Cordilleran Region
9. The Western Arctic Islands

The iron formations found in belts of Pre-Cambrian sedimentary and volcanic rock are the principal iron ore resources of Canada. Good quality ore is not available in the Western Plains region, and ore reserves in the Cordilleran region are relatively small.

The map shown in Figure 4 shows the distribution of the iron resources of Canada, and Table 15 gives a summary of the reserves and potential ore resources of the principal regions.

d) Ontario Markets

Ontario producers shipped 11.3 million metric tons of iron ore in 1973, a 5% increase over 1972 shipments. 4.5 million metric tons were exported and 6.8 million metric tons were consumed domestically. The three major steel companies in Ontario consumed as estimated 12.6 million metric tons of iron ore in 1973. During this same period, the consumption of Ontario ore by Canadian consumers rose from 3.3 million metric tons to 6.8 million metric tons, (Canadian consumers of Ontario iron ore are essentially Algoma Steel Corp., Dominion Foundries and Steel Company and the Steel Company of Canada, all in Ontario). Production and consumption data are given in Table 16 and in Figure 5. There are presently nine producing iron ore mines in Ontario. (Table 17).

The projected tonnage of ore shipments for 1974 is 11.6 million metric tons, about the same as for 1973.

The Caland Ore Company had expected to cease mining operations in 1976. Recent announcements indicate that Caland may be able to delay closing the mine until 1979 and the pellet plant in 1981. If the Caland operation does close in 1976, the mine lessee, Steep Rock Iron Mines, will likely continue mining beyond 1976 to supply ore to its Atikokan pellet plant.

In 1972, INCO cancelled plans to complete its 254,000 metric TPY expansion of the iron ore pellet plant at Sudbury. The existing plant produced 635,000 metric tons in 1973, well below its 823,000 metric TPY capacity.

In 1972 the Nickel Iron Refinery of Falconbridge Nickel Mines Limited was closed as uneconomic.

The Steel Company of Canada has recently announced installation of a direct reduction kiln (SL/RN Process) to produce 406,000 metric TPY of reduced pellets at the Griffith Mine. No expansion of the mine capacity is planned.

The Adams Mine of Dofasco has recently announced an expansion program to increase pellet capacity by 50,000 to 60,000 metric TPY, for a total capacity of 1.2 million metric TPY.

Algoma Steel Corp. has resumed exploration work on the Eagle Island property of Lake St. Joseph Iron Ltd., in the Lake St. Joseph area.

The Marmoraton Mine of Bethlehem Chile has reserves for a further 7 years, and is expected to close in 1979-1980.

The iron ore shipments from Ontario mines for 1974-1981 were projected, based on announced plans for plant closures and new capacity. (See Table 18). It was assumed that the Lake St. Joseph project would operate at full capacity of 4 million TPY in 1978, which now appears unlikely.

Iron Ore Reserves in Ontario

It was estimated in 1968 that there are 8,100 million metric tons of known iron ore reserves and resources in Ontario [1] with an average grade of 29% iron. This figure included 6,870 million metric tons of calculated resources which have been outlined by development work and a further 1,230 million

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(1) R. Shklanka - "IRON ORE DEPOSITS OF ONTARIO", Mineral Resources Circular No. 11 Ontario Department of Mines, 1968.

metric tons to accommodate the resources of know deposits for which data were not available. If resources of less than 20% iron are ignored, the known tonnage decreases to 6,500 million resources with more than 20% iron.

The iron ore prospects in Ontario are listed in Appendix B. The iron ore deposits have been listed as reserves, conditional resources and hypothetical resources, according to the definitions set out in Appendix C. The total tonnage is 5,180 million metric tons, representing about 135 years' supply at the current rate of consumption of 13 million metric tons per year. These reserves and resources include indicated resources, and also give no indication of the economic aspects of the deposits. The figures merely show that the iron ore resources are adequate for all purposes of policy planning.

Properties in Ontario which have potential for large scale development are listed in Table 20. There is presently active interest in several of these properties.

Steep Rock Iron Mines is studying the feasibility of developing the Lake St. Joseph deposit to produce 4 million metric tons of concentrate per year. At a later date, depending of fuel availability and technology, about 2 million metric tons of pellets could be reduced to metallized pellets.

The Errington Township property has been leased to Algoma Steel Corp. by Little Long Lac Mines. Algoma is continuing a program to delineate and sample the deposit. The Eagle Island prospect in the Lake St. Joseph area, on which Algoma holds an option, is again under study in conjunction with PAIT.

Table 21 contains reserve data of producing mines using a 25% Fe cut-off grade. These reserves do not necessarily represent economically recoverable ore. The total reserves at the producing mines is 791.6 million metric tons, with an average grade of 25% Fe. If a concentrate grade of 67% Fe is assumed and a recovery of 75%, then the number of years of ore as reserves is 38 years, based on a shipping rate of 13.0 million metric tons per year (1972 data). If the shipping rate is assumed to grow at a compounded rate of 5% per year, the present reserves represent about 20 years of supply.

e) Prices

Iron Ore Prices

The geographical and historical trends of iron ore prices are somewhat elusive, partly because many of the larger sellers and consumers are integrated and generally keep their contracts confidential.

The FOB price publications for iron ore are of little real significance unless the market destination is specified. Prices quoted for iron ores are generally the FOB producer price. The price at destination is strongly influenced by the shipping costs, which are normally born by the purchaser.

Currency realignments have considerable impact on iron ore prices because the material is truly international in character. They have resulted in increases of up to 17% in the price of ores entering the Japanese market, B.C. concentrates are priced at U.S. $9.07 to $9.12 per dry metric ton (FOB) and eastern Canada concentrates are sold at a contract price of U.S. 16.4¢ per dry long ton unit (for a 67% concentrate, the price would be $10.66/dry metric ton).

Typical price ranges for Australian ores are shown by the historical prices for Hammersley Lump ore (64% Fe) (Table 22).

The Lake Erie base price for iron ore quoted is highly artificial, referring to the value of ore delivered to the "rail of the vessel" of the lake ore carriers docked at the Lake Erie ports. The price is usually established at the beginning of the shipping season and is based on a substantial sale of ore for delivery during the next eight months. (Table 23)

Scrap Prices

Scrap steel and iron plays an important part in the steel making industry. Sponge iron can replace scrap in electric furnaces. Increased scrap prices enhance the potential for the production of sponge iron pellets containing about 90% Fe and no undesirable residuals.

During 1973 scrap prices rose dramatically and in 1974 approached $150 per ton on the Chicago scrap market. This price has since dropped below the $80 range.

In mid 1973 the U.S. moved to curtail the export of steel scrap because it was in short supply and because it represented a considerable export of energy at a relatively cheap price. These export controls were removed at the beginning of 1975 but could of course be re-imposed at any time.

Scrap prices and U.S. exports are shown for 1973 and 1974 in Figures 7 and 8.

2.2.2 Developments in the Iron Ore Industry

a) World Developments:

Major developments are taking place on a world-wide scale. In South America, Brazil will have 8.2 million metric tons per year pellet capacity at Tulsarao, and at Aquas Claras the mine capacity will be at 11.5 million metric tons per year by 1975. In Argentina there will be capacity for 2 million metric tons of ore per year by 1975 at Sierra Grande.

In Africa, the Mt. Nimba deposits of Guinea are being developed to produce 8.5 million metric tons of ore per year by 1975, and in Liberia, Lamco is constructing a 1 million ton per year plant to produce washed fines.

In Western Australia, Mt. Newman Mining will add 10 million tons per year capacity to its existing plant by the end of 1974, for a total capacity of 35 million tons per year. Hammersley Holdings is expanding their pellet facilities from 2.6 million to 3.2 million tons per year capacity.

Many other developments are in the planning or in the feasibility study stage. Under consideration are such huge projects as the 20 million ton per year mine at Carajas, Para, Brazil, with a possible expansion to 50 million tons by 1982. A 15 million ton per year project at Sishen, South Africa is under study by ISCOR.

b) U.S. Developments:

Three major developments will come into production in the next two or three years. The Tilden Mine will ultimately produce 12 million tons per year at full capacity and is expected to start up in 1974 with a 4 million TPY capacity. The Tilden Mine will export 2.0 million tons per year to Canadian consumers. Cleveland Cliffs is also expanding the Empire Mine from 3.5 million to 5.3 million TPY pellet capacity with start-up in 1974. A 5.4 million ton per year pelletizing plant is being built at Hibbing, Minnesota, by Bethlehem Steel and Pickands Mather and Company and Stelco (10%) with start-up planned for 1976.

The Eveleth Taconite Company is undergoing an expansion of capacity from 2.4 million tons to 6 million tons per year, to come on stream in 1976. Inland Steel is building a 2.6 million tons per year mine and pellet facility near Virgina, Minnesota for start up in 1977.

U.S. Steel's Mintac project would produce an additional 6.0 million TPY and National Steel's new pellet plant a further 3.4 million TPY, additional pellet capacity.

c) Canadian Developments:

- In Quebec

The major ore producers of Quebec-Labrador have undergone extensive expansion in recent years. The Iron Ore Company of Canada's Carol Lake concentrator increased its capacity by 10 million tons per year in 1973. A 12 million metric ton per year pellet plant at Sept-Isles was also completed during the year. At Mount Wright, Quebec Cartier is developing a 16 million TPY iron ore mine and concentrator with start-up planned for late 1974 or early 1975. Plans have been recently announced to develop the Fire Lake deposits in Quebec. Sidbec-Dosco and Quebec Cartier are involved in the development estimated to cost $250 million. The capacity is reported to be 5 million tons per year of concentrate (66.5% Fe) with start-up originally expected in 1977, having taken place by now.

There is also a possibility of a new mine and pellet production complex in Chibougamau with participation of the Quebec government.

d) Ontario Developments:

Present developments in the Ontario iron ore and steel industries indicate a period of slow growth for iron ore mining. The integrated steel-makers of Ontario are arranging for out-of-province suppliers to meet their expanding iron ore needs. Algoma has an equity position for 1.2 million tons annually in the Tilden project in Michigan and will purchase an additional 0.1 million tons starting in 1974. Stelco's equity is for 0.4 million tons a year with additional purchases of 0.3 million tons anticipated. Stelco also has equity in the Eveleth Taconite mine which is to start production in 1976. These two projects will provide Stelco with 1.4 million tons per year of iron ore pellets. The Fire Lake project, if completed, will produce a total of 5 million tons per year of concentrates. Dofasco is taking part in the Eveleth Taconite Company expansion and will receive 600,000 tons per year of pellets when production starts in 1976.

The Ontario mines do not presently have plans for significant capacity expansion. The only iron ore project under development in the province, Steep Rock Iron Mines' Lake St. Joseph property, has not yet arranged its senior financing. Exploration and metallurgical test work is being done by Algoma at Eagle Island in the Lake St. Joseph area and in Errington Township near Geraldton. Stelco is investigating the deposits at North Spirit Lake.

The Caland operations at Atikokan represent the major iron ore sources for Inland Steel Company of Chicago. The company mines an orebody owned by Steep Rock Iron Mines and pays a royalty based on a percentage of market value.

The Caland Ore Company plans to close the mine in 1979, and will cease operations at the pellet plant in early 1981 when stockpiled ore is exhausted. The possible extension of mine operation until 1980 is being investigated, as enquiries were received from IPSCO (Interprovincial Pipe and Steel Company, owned by Saskatchewan, Alberta and the public) for the shipment of about 800,000 tons per year of ore to Regina. No decisions have been made at present, as the practicality of the venture, and the impact of changed mining tax regulations, are being studied.

Inland Steel Company has recently announced that it will develop the Minorca Project near Virginia, Minnesota, to replace the ore lost when the Caland mine closes.

The Marmoraton Mine, owned by Bethlehem Steel, will be depleted by 1979-1980 and will close. Thus, the Ontario industry will most likely find its exports decreasing and its domestic shipments stagnant or only slowly growing, in the face of a growing market for iron ore. Domestic consumption is expected to grow at a rate of 5.5% per year, and Canada's exports are projected to show an annual growth rate of about 8%.

Ontario production will decrease without the addition of new iron ore production capacity.

2.2.3 Economics of Ontario's Iron Ore Industry

The purchasers of iron ore are frequently also the owners of the mine. This has led to an artificially low price for the iron ore, and in general a very low rate of return on investment in the iron ore industry. Table 24 contains aggregated data for the industry for 1972. Seven mines were included in aggregating the data.

In 1972, the Ontario iron ore mining industry incurred a loss of $4.1 million, representing a loss-margin (after taxes) of 3.66% on gross value of $111.8 million. The highest profit margin was 4.4% and the greatest loss incurred was 14%.

The low prices set for the product allow the profits that should normally accrue to the mining operation to be transferred to the steel-making operation. In the case of

a foreign purchaser - mine owner, the profits are exported out of the country and are not subject to federal and provincial income taxes, as is the case with domestic purchasers.

The real price of iron ore is unlikely to increase significantly in the near future. Present price increases of about 30% which have occurred in late 1973 and early 1974 are a result of large increases in shipping and handling costs. The price will remain suppressed as a result of a world-wide excess of supply over demand, and the existence of large, high grade reserves throughout the world. The introduction of very large ocean carriers will also minimize transportation costs resulting in a very competitive world market and low FOB destination costs.

2.2.4 Impact of Technology

Equipment and Capacity

As the benefits of prepared burden in the blast furnace became apparent to the steelmakers, the demand for beneficiated and agglomerated iron ore feed increased dramatically. From its beginning in 1954, the consumption of iron oxide pellets in the U.S. has grown to almost one-half of the total iron ore consumed. This growth has been at the expense of direct shipping ores and iron ore concentrates. Coupled with the exhaustion of the high-grade Lake Superior ores at the end of the 1940's, this led to the development of processes for concentrating and agglomerating the low-grade deposits in the Lake Superior region. To remain competitive and off-set the cost of increased processing, larger and better equipment was developed such as haulage trucks, drilling rigs, power shovels and blasting agents. The advances made allowed developments to be carried out on a scale never before possible. The resulting decrease in costs and increases in productivity have allowed the profitable recovery of iron units from material that would be formerly considered as waste rock.

Transportation

Improvement in transportation technology has been a key factor in the competitive development of remote iron ore resources. The unit-train concept and the super-carriers have had a major influence in an industry where transportation costs may amount to 50 to 60% of the delivered ore price. Table 25 compares ore shipping costs

from Quebec to Pittsburgh by current rail routes with the average water shipment costs from Quebec to world markets via super carriers. Their leveling effect on ocean shipping rates makes any high-grade agglomerate competitive with any other when using an all-sea route. The full impact of the super bulk carrier is yet to be felt, as the ore/bulk/oil (OBO) concept is still being developed. This will reduce shipping costs even further by backhauling part of the way with oil and the remainder of the way with coal.

In the Great Lakes market, the high cost of shipping ore inland from the east coast has discouraged the importation of overseas ores in favour of ores and pellets from the Lake Superior and Labrador regions. There may be considerable potential for cost reduction in transporting these ores to inland markets by the use of large ocean-going bulk carriers in combination with unit trains.

The Marconaflo system of transporting ore also has potential for major cost reduction in ore handling. In this system the ore-carriers are loaded and unloaded by pumping the ore as a slurry; the ore is dewatered when on board and is shipped as a compact solid. One great advantage of this system is the ability of the large carriers to use single-point mooring systems and thus unload at ports that do not have deep water dock facilities. Other advances in transportation which help maintain the highly competitive nature of the iron ore industry are: the self unloading ships with capacities in excess of 10,000 tons per hour, and the modern large-scale, efficient transshipping facilities.

Direct Reduction

The direct reduction process for steel making replaces the blast furnace in removing oxygen from iron ore. The ore is processed in the solid state and the sponge iron product is reduced to steel in the electric furnace or used as a "coolant" in the basic oxygen furnace (BOF). The direct reduction process does not require coking coal as the reductant but can make use of natural gas, reformed gas and non-coking coals. It may be economical at much smaller tonnage capacity than the blast furnace, which must operate at a capacity of several million tons per year. The high capital cost of a new blast furnace will make direct reduction installations much more attractive to developing nations and to markets with a relatively small demand for steel. Recent changes in the natural gas market will necessitate thorough revisions of projects based upon the Midrex process.

Annual world direct iron capacity is estimated at 5.1 million metric tons, containing from 85% to 95% iron. Currently, the United States, with 1.22 million metric tons

or 23% of the total capacity is the leading producer in the world. About 2.75 million metric tons yearly capacity is scattered in nine countries. Current capacity of direct iron in the world is summarized in Table 24. Planned capacity will more than double the present level, principally through the addition of a plant in the USSR with an annual capacity of 5 million metric tons of pre-reduced pellets. This plant would be the largest in the world. The annual world demand for direct iron products is expected to increase to 15.25 million metric tons by 1975 and to 66 million metric tons by 1980. This is based on estimated growth of steel consumption to over 939 million metric tons in 1980.

2.2.5 Impact of Inflation

Steel Industry Projections

Inflation has characterized most of the world's economies over the last decades, and even the few hold-outs have succumbed during the past few years when rates of inflation accelerated sharply. Inflation generally leads to overexpansion of the capital goods sectors at the expense of the consumer goods sectors. The significant factor here is that the bulk of steel demand is from the former. In the U.S.A. approximately 70% of all steel is consumed by the transportation, construction and industrial and agricultural machinery and equipment sectors. These are the sectors that would be most sensitive to a reaction to the past inflationary boom. Canadian steel production is roughly 10% of that of the U.S. and two thirds of all Ontario steel products (three quarters of all Canadian) exported goes to the U.S. On the basis of the data discussed so far, it appears that the U.S. steel industry would be less likely to incur losses during a recessionary adjustment on account of previous overexpansion than would the Canadian steel industry. As regards the rest of the world (excluding the Communist Block), relatively high rates of expansion are projected over the next decade for the under-developed African, Asian and South American countries. Inflationary overexpansion of their capital goods sectors has, if anything, been accelerated by various forms of forced development planning. These economies are likely, in the next decade, to be affected by any or all of: general recessionary adjustments, higher energy prices, steeply increasing bills for food imports and severe capital shortages. On the whole the export potential to the "third world" for steel products may be less than anticipated and subject to sharper competition from Europe and Japan than the U.S. market. In summary then,

it may be argued that not only the expansion of U.S. demand, but of world demand, will flatten out significantly. The Canadian steel industry then may suffer from a severe under-utilization of capacity in the late '70's and in the '80's. If projections of population growth continue to be revised downwards as they have been repeatedly in recent years the above arguments would be reinforced.

Iron Ore Industry Projections

Iron ore capacity on the whole appears to be planned to meet the steel demand projections. Less than anticipated growth in steel consumption would then be reflected almost immediately in under-utilization of planned iron ore production capacity. An over-expanded steel industry would be under considerable pressure to cut input costs, and foreign iron ores would tend to improve their competive position vis-a-vis Ontario ores for two reasons:

- Bulk freight capacity has over-expanded in the past and this is already beginning to tell in terms of bulk ocean freight rates. The anticipated re-opening of the Suez Canal would tend to depress rates further.

- Underdeveloped countries which are now expanding their iron ore capacity would be faced with declining demand and ever increasing trade deficits. They would then be forced into strong competition for the sale of their ores.

3. Conclusions

- The iron and steel industry domestically and world-wide appears to be headed for a decade of steady growth, barring extraordinary recessionary adjustments.

- Recent changes in the oil and gas markets necessitate a downward revision of previous high expectation for the growth of direct reduction installations.

- With proper incentives Ontario's industry could be in a good position to take advantage of such expansion opportunities as still exist.

- Growth of the direct-reduction industry is inopportune at this time. Although sponge iron is not a fully refined product, it has received a high degree of processing and thus conforms with the policy requirements of the province.

- Presently, processing of iron ores in Ontario encompasses beneficiation, concentration and agglomeration to sinter or iron oxide pellets.

- In spite of the promising demand picture the Ontario iron ore industry is in a period of slow growth or stagnation.

- Although the province's steel industry is expanding capacity, it is increasingly going outside of Ontario for its iron ore requirement.

- At present there are no firm plans to expand existing capacity for iron ore production in Ontario, and plans for new capacity are uncertain.

- Ontario's iron ore industry faces stiff competition from the mines of Quebec, Labrador and of the Marquette and Mesabi ranges of the U.S.

- Ontario's existing mines have relatively small reserves of ore compared to the immense reserves of the Mesabi and Marquette ranges of the U.S. Lake Superior mining region, and those of the Quebec-Labrador trough.

- Ontario's iron ore deposits are also relatively low-grade and thus require extensive beneficiation, increasing the cost of production.

- The very large scale of the Quebec-Labrador, Marquette and Mesabi range operations provide economies of scale not available to the smaller Ontario mines.

- The world resources of iron ore are vast and fairly evenly distributed.

- If Ontario's industry is to share in the growth of the iron ore industry, existing obstacles must be removed, and some incentives to growth restored.

- Since Section 113 was re-applied to iron ore in 1970 it has impeded the negotiation of long-term contracts with foreign investors.

- The opportunities for growth which appear to be most beneficial to Ontario are:

(i) New mines and/or expansion of existing mines owned by integrated Canadian steel producers.

(ii) growth of the direct-reduction segment of the industry.

- The expansion of integrated mines will lead to the maximum processing of Ontario ores in Ontario.

- Notwithstanding the potential for coal-fired sponge iron technology, it is doubtful if the smaller iron ore deposits in Ontario will be developed. To-day the minimum economic size for pellet production appears to be 3,000,000 metric tons per year.

TABLES

TABLE 1A

WORLD IRON ORE PRODUCTION

(Sources: U.S. Bureau of Mines, and American Iron and Steel Institute)

(Thousands of Metric Tons)

COUNTRY	1967	1968	1969	1970	1971	1972	1973
NORTH AMERICA							
Canada	38,446	48,205	34,739	46,101	45,700	39,649	43,976
Mexico	2,696	3,202	3,948	4,180	5,400	4,717	2,900
United States	85,531	87,244	89,677	91,233	83,619	76,645	88,607
TOTAL NORTH AMERICA	126,671	138,650	128,365	141,513	134,719	121,010	135,483
SOUTH AMERICA							
Brazil	23,500	25,198	28,001	30,000	32,501	30,516	42,526
Chile	11,025	11,917	11,532	11,051	11,260	8,641	9,500
Columbia	808	578	1,200	1,300	600	600	650
Peru	7,659	9,015	9,072	9,500	9,500	12,001	13,000
Venezuela	17,125	16,190	19,392	21,400	22,501	17,328	18,975
TOTAL SOUTH AMERICA	60,117	62,899	69,197	73,251	76,362	69,086	84,652
WESTERN EUROPE							
Austria	3,473	3,482	3,982	3,920	4,100	4,132	4,220
Finland	648	864	1,058	1,050	1,150	992	740
France	49,221	55,301	56,019	57,406	56,480	54,857	60,626
West Germany	8,553	6,447	7,451	6,762	6,391	6,117	6,429
Italy	1,024	1,058	1,157	1,168	1,030	842	752
Luxembourg	6,304	6,393	6,311	5,722	4,540	4,116	4,237
Norway	3,232	3,699	3,792	3,920	3,820	3,921	4,315
Portugal	196	203	164	140	105	43	36
Spain	5,085	6,185	6,253	6,979	7,080	6,684	7,030
Sweden	28,271	32,420	33,278	30,700	33,340	33,124	34,451
United Kingdom	12,945	13,935	12,298	12,150	10,650	9,048	6,350
Yugoslavia	2,580	2,720	2,721	3,530	3,790	3,960	4,670
TOTAL WESTERN EUROPE	121,532	132,707	134,484	133,448	132,476	127,835	133,655
EASTERN EUROPE							
Czechoslovakia	1,914	1,572	1,568	1,580	1,560	1,580	1,675
East Germany	1,680	1,414	900	900	400	264	250
Hungary	638	680	681	590	660	694	690
Poland	3,075	3,050	2,768	2,580	2,600	1,656	1,700
Romania	2,796	2,747	2,999	3,150	3,360	3,361	3,400
U.S.S.R.	168,002	176,616	186,177	195,003	203,603	207,603	216,003
TOTAL EASTERN EUROPE	178,105	186,080	195,093	203,803	212,183	215,158	223,718
FAR EAST							
China	28,043	38,001	42,501	43,000	44,001	45,000	45,000
Hong Kong	144	162	166	170	160	162	160
India, Incl. Goa	26,157	27,434	28,348	29,250	31,631	35,196	33,896
Japan	2,219	1,892	1,856	1,560	1,420	1,348	1,075
Malaysia	5,436	5,167	5,236	4,591	1,100	550	528
Philippines	1,506	1,353	1,560	1,600	2,240	2,208	2,360
TOTAL FAR EAST	63,506	74,008	79,666	80,171	80,552	84,464	83,019
TURKEY	1,485	1,989	2,508	2,350	3,000	1,955	1,100
AFRICA							
Algeria	2,570	3,079	2,964	3,000	2,750	2,700	2,600
Morocco	884	807	752	890	650	234	298
Liberia	18,224	19,571	21,744	23,000	25,700	21,000	21,501
Sierra Leone	2,098	3,000	2,350	2,501	2,220	2,493	2,400
Tunisia	919	1,016	946	680	910	890	775
Rep of S. Africa	7,737	8,233	8,790	9,300	10,700	11,173	10,700
TOTAL AFRICA	32,432	35,706	37,545	39,371	42,931	38,489	38,274
Australia	18,814	26,394	39,103	45,900	57,600	62,100	75,001
Other	22,964	37,277	31,806	33,753	30,481	31,537	31,973
WORLD TOTAL	625,422	685,270	717,766	753,561	770,305	751,636	807,076

TABLE 1B

WORLD IRON ORE PELLET CAPACITY

COUNTRY	ANNUAL CAPACITY, 1973 (MILLION METRIC TONS)
United States	62.39
Canada	31.30
Australia	10.11
Belgium	0.61
Brazil	5.08
China	1.12
Finland	0.61
France	0.10
India	1.52
Italy	0.34
Japan	9.72
Liveria	4.06
Mexico	1.73
Morocco	0.86
Netherlands	3.40
Norway	3.60
Peru	4.06
Phillipines	0.76
Portugal	2.03
Sweden	10.27
U.S.S.R.	13.72
Yugoslavia	0.61
WORLD TOTAL	167.99

Sources: World Iron-Ore Pellet and Direct-Iron Capacity, U.S. Dept. of Commerce, Feb. 1973, and Skillings Mining Review.

TABLE 2

PLANNED NEW PELLET CAPACITY

COUNTRY	ANNUAL CAPACITY MILLION METRIC TONS	START-UP DATE
U.S.S.R.	6.10	1977
United States	15.04	1975/76
Argentina	2.03	1975
Brazil	3.05	1976
Chile	3.56	1977
Mexico	4.57	1975/76
Peru	3.56	1975
England	6.10	1975
TOTAL	44.0	1975/77

Sources: As for Table 1B

TABLE 3A

WORLD RAW STEEL OUTPUT

MILLION METRIC TONS	1974	1973	1972	1971	1970
U.S.A.	132.0	136.5	120.7	109.3	119.3
U.S.S.R.	N.A.	131.0	126.-	120.6	115.9
Japan	117.1	119.3	96.9	88.6	93.3
Fed. Rep. of Germany	53.2	49.5	43.7	40.3	45.0
U.K.	22.5	26.7	25.4	24.2	27.9
France	27.0	25.3	4.1	22.9	23.8
China	N.A.	25.-	23.-	21.0	18.5
Italy	23.9	21.0	19.8	17.5	17.3
Belgium	16.2	15.5	14.5	12.4	12.6
Poland	N.A.	14.2	13.5	12.7	11.8
Canada	13.6	13.4	11.9	11.0	11.2
Czechoslovakia	N.A.	13.2	12.7	12.1	11.5
Spain	11.5	10.8	9.5	8.0	7.4
Rumania	N.A.	8.0	7.4	6.8	6.5
Australia	7.8	7.7	6.8	6.8	6.8
Brazil	7.6	7.2	6.6	6.0	5.4
India	7.0	6.9	6.9	6.1	6.3
German Dem. Rep.	N.A.	6.0	5.8	5.4	5.1
Luxemburg	6.4	5.9	5.5	5.2	5.5
Sweden	6.0	5.7	5.3	5.3	5.5
South Africa	5.8	5.7	5.3	4.9	4.8
Netherlands	5.8	5.6	5.6	5.1	5.0
Mexico	5.1	4.8	4.4	3.8	3.9
Austria	4.7	4.2	4.1	4.0	4.1
Hungary	N.A.	3.3	3.3	3.1	3.1
North Korea	N.A.	2.9	2.-	1.8	1.7
Yugoslavia	N.A.	2.8	2.6	2.5	2.2
Bulgaria	N.A.	2.3	2.1	1.9	1.8
Argentina	2.4	2.2	2.1	1.9	1.8
Others	N.A.	13.3	12.3	10.7	10.6
TOTAL	475.6*	695.9	629.8	581.9	593.6

Source: Int'l. Iron and Steel Institute, Brussels, Belg.

* Major Free World producers only.

TABLE 3B

STEEL CONSUMPTION PROJECTION

MILLION MT	1970	1975	1980	1985
U.S.A.	126.5	152.5	170.0	190.0
Canada	11.1	13.5	16.5	20.0
Latin America	18.3	25.0	35.0	48.0
Oceania	7.5	9.7	12.2	15.3
ECSC	96.7	107.6	128.8	153.2
United Kingdom	25.5	27.8	32.9	35.9
Other Western Europe	35.8	44.0	58.8	77.7
U.S.S.R.	109.9	144.8	183.9	215.0
Eastern Europe	41.9	56.4	74.1	91.2
Japan	70.6	91.3	112.5	133.8
India	6.1	10.2	14.4	20.0
China & North Korea	22.2	35.3	53.0	79.0
Other Asia	8.2	14.4	22.3	31.1
South Africa	4.9	6.1	8.2	10.8
Other Africa	4.2	4.3	5.3	6.5
Middle East	5.0	7.8	11.3	16.9
TOTAL	594.3	750.7	939.2	1,144.4

Source: International Iron and Steel Institute, Brussels, Belgium "Projections 85"

TABLE 4

STEEL CONSUMPTION GROWTH RATES

PERCENT PER ANNUM	1955-60	60-65	65-70	70-75	75-80	80-85
U.S.A.	-2.6	7.4	-0.3	3.8	2.2	2.3
Canada	1.8	13.8	1.0	4.0	4.1	3.9
Latin America	4.5	7.4	7.9	6.5	7.0	6.5
Oceania	5.6	7.8	2.2	5.3	4.7	4.6
E.C.S.C.	6.3	2.9	7.7	2.2	3.7	3.5
United Kingdom	3.6	0.7	1.9	1.7	3.4	1.8
Other Western Europe	7.3	8.9	7.4	4.2	6.0	5.7
U.S.S.R.	7.8	6.4	5.0	5.7	4.9	3.2
Eastern Europe	10.8	5.0	5.8	6.1	5.6	4.2
Japan	22.1	8.2	19.6	5.3	4.3	3.5
India	10.8	8.6	-3.5	10.6	7.1	6.8
China & North Korea	36.2	-5.0	9.3	9.7	8.5	8.3
Other Asia	8.4	11.5	9.3	12.0	9.1	6.9
South Africa	1.7	14.6	2.7	4.6	6.1	5.7
Other Africa	3.7	3.3	9.9	0.5	4.3	4.2
Middle East	6.0	8.5	7.6	9.4	7.7	8.4
WORLD	5.0	5.8	5.4	4.8	4.6	4.0

Source: As for Table 3B

TABLE 5

PRINCIPAL IRON ORE RESOURCES OF THE WORLD,

SIGNIFICANT 1969-2000*

(BILLION TONS)

	PRIME ORE		MEDIOCRE ORE		MARGINAL ORE	
COUNTRY	QUANTITY	GRADE %	QUANTITY	GRADE %	QUANTITY	GRADE %
North America:						
Canada	12.0	30+	4.0	50+	12.0	30+
United States	10.0	28+	5.0	50	10.0	40+
South America:						
Brazil	2.4	66	.6	60	25.0	50+
Chile	1.0	60+	---	--	----	--
Peru	1.0	50+	---	--	----	--
Venezuela	3.5	58	---	--	.3	50-
Europe:						
E.C.S.C.	--	--	---	--	11.2	30-
United Kingdom	--	--	---	--	2.7	30-
Spain	--	--	2.3	50-	----	--
Sweden	3.5	60+	---	--	----	--
U.S.S.R.	58.3	40+	32.7	40-	----	--
Yugoslavia	--	--	---	--	.4	28
Africa:						
Gabon	1.0	60+	---	--	----	--
Liveria	.7	50+	---	--	----	--
Mauritania	.2	65	---	--	----	--
Republic of South Africa	1.2	55	5.4	45	2.0	40
Asia:						
China	--	--	---	--	11.0	32
India	21.6	60	---	--	----	--
South Korea	--	--	---	--	.1	35
North Korea	--	--	.2	35+	----	--
Malaysia	--	--	.1	50	----	--
Australia	16.0	60+	---	--	----	--
TOTAL	132.4		50.3		74.7	

* SOURCE: Bureau of Mines IC 8574, 1973, Iron, A Materials Survey.

TABLE 6

WORLD IRON ORE RESOURCES

(MILLION LONG TONS)

REGION	RESERVES	POTENTIAL ORE	TOTAL RESOURCES
Africa	6,693	24,113	30,806
Middle East, Asia, and the Far East	17,027	53,344	70,371
Australia, New Zealand and New Caledonia	16,535	Vast	16,535
Canada and West Indies	35,727	87,988	123,715
Europe	20,964	12,598	33,561
South America	33,561	57,478	91,039
U.S.S.R.	108,755	190,739	299,494
United States of America Puerto Rico, Mexico and Central America	8,070	96,550	104,620
TOTAL	247,332	522,810	770,141

Source: As for Table 5

TABLE 7

WORLD IRON ORE MARKETS

IMPORTERS (MARKETS)	EXPORTERS (SOURCE)
U.S. - Lower Great Lakes (Major)	Upper Great Lakes, E. Canada
U.S. - Chicago (minor)	Upper Great Lakes, E. Canada
U.S. - East Coast (major)	Venezuela, Liberia, E. Canada
U.S. - Gulf of Mexico (Minor)	Venezuela, Peru, Chile
Europe - North Sea (Major)*	Liberia, Sweden, E. Canada Brazil, Mauritania
Europe - Mediterranean (Minor)	Mauritania, Liberia, USSR
Japan - (Major)	Australia, Canada, Peru Chile, Brazil, S.E. Asia Liberia, India

* W. Germany, Britain, Belgium and Netherlands

TABLE 8

U.S. RAW STEEL PRODUCTION

(Thousands of Metric Tons)

MARKET AREA	1968	1969	1970	1971	1972
EASTERN SEABOARD	48,265	51,266	46,410	41,563	44,252
GULF COAST	4,183	4,640	4,576	4,114	4,365
GREAT LAKES	54,654	59,418	55,790	52,016	60,465
WEST COAST	12,160	12,827	12,533	11,572	11,793
TOTAL	119,262	128,152	119,309	109,265	120,875

Source: American Iron and Steel Institute.

TABLE 9

U.S. DOMESTIC IRON ORE SHIPMENTS (1972)

STATE	METRIC TONS ($x10^3$)	LOCATION PERCENTAGE	TOTAL PERCENTAGE
Minnesota	50,497	65.7%	44.6%
Michigan	11,583	15.1%	10.2%
New York	2,195	2.9%	1.9%
Pennsylvania			
Utah	1,880	2.4%	1.7%
Wyoming	2,047	2.7%	1.8%
Other	8,643	11.2%	7.6%
TOTAL	76,845	100.0%	67.9%

Source: U.S. Bureau of Mines Minerals Yearbook

TABLE 10

U.S. IMPORTS OF IRON ORE, BY COUNTRY (1972)

STATE	METRIC TONS ($x10^3$)	PERCENTAGE	TOTAL PERCENTAGE
Canada	18,549	51.1%	16.4%
Venezuela	11,101	30.5%	9.8%
Brazil	1,133	3.1%	1.0%
Liberia	2,805	7.7%	2.5%
Peru	1,339	3.7%	1.2%
Other	1,408	3.9%	1.2%
TOTAL	36,335	100.0%	32.1%

Source: U.S. Bureau of Mines Minerals Yearbook

TABLE 11

U.S. IRON ORE SHIPMENTS AND IMPORTS
(Metric Tons)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Total U.S. Shipments						127,897	132,683	134,188	119,112	113,182
U.S. Internal Shipments						83,250	91,297	88,576	78,344	76,847
Total U.S. Imports	33,797	43,089	45,827	47,002	45,327	44,647	41,386	45,612	40,768	36,335
Imports from Canada	19,194	25,253	24,138	24,325	24,603	26,761	19,283	24,318	20,669	18,460
Other Imports	14,603	17,836	21,689	22,677	20,724	17,886	22,103	21,294	20,099	17,875

Source: U.S. Bureau of Mines Minerals Yearbook.

TABLE 12

CANADIAN IRON ORE SHIPMENTS

	1971	1972	1973
Canada-Total	42,958,000	39,654,000	48,956,000
Newfoundland	19,847,000	16,651,000	21,895,000
Quebec	10,141,000	11,614,000	14,408,000
Ontario	11,219,000	10,222,000	11,247,000
British Columbia	1,751,000	1,167,000	1,406,000
Byproduct Iron Ore	944,000	758,000	630,000

Source: Canadian Iron Ore Industry Statistics 1971-1972, and Iron Ore, Canadian Minerals Review, EMR, Ottawa.

TABLE 13

SHIPMENTS, EXPORTS AND IMPORTS OF IRON ORE IN CANADA

(METRIC TONS)

YEAR	SHIPMENTS	EXPORTS	IMPORTS
1973	48,956,000*	38,502,000	277,600
1972	39,653,000	29,275,000	1,753,000
1971	42,958,000	34,164,000	1,384,000
1970	47,459,000	39,348,000	2,160,000
1969	36,337,000	28,354,000	2,297,000
1968	42,064,000	36,589,000	2,794,000

* Shipment data for 1973 in wet metric tons, shipment data prior to 1973 in dry metric tons.

Source: As for Table 12

TABLE 14

EXPORTS OF CANADIAN ORE - BY DESTINATION

	1971	1972	1973
United States	20,420,000	18,437,000	21,852,000
Britain	4,790,000	3,553,000	5,383,000
Japan	3,150,000	1,917,000	3,872,000
West Germany	1,320,000	776,000	3,724,000
Italy	1,518,000	1,380,000	1,807,000
Spain	598,000	798,000	566,000
Netherlands	2,017,000	1,945,000	450,000
France	200,000	305,000	376,000
Others	224,000	163,000	472,000
TOTAL	34,164,000	29,275,000	38,502,000

Source: As for Table 12

TABLE 15

IRON ORE RESOURCES OF CANADA

(IN MILLIONS OF METRIC TONS)

REGION	RESERVES	POTENTIAL ORE	TOTAL RESOURCES
Appalachian	10	2235	2245
Grenville	750	9175	9925
Labrador Geosyncline	20,600	32,630	53,230
Southeast Canadian Shield	7295	7210	14505
Northern Canadian Shield	-	10,610	10,610
Western Plains	-	2200	2200
Cordilleran	168	10,324	10,492
TOTAL	33,628	86,389	120,017

TABLE 16

ONTARIO IRON ORE SUPPLY AND DEMAND

	ONTARIO IRON ORE SHIPMENTS					
	Total Shipments (Metric Tons)	Ontario Ore Exported (Metric Tons)	Ontario Ore Consumed in Canada ≠ (Metric Tons)	Ontario's Iron Ore Demand (Metric Tons)	Raw Steel Production≠ (Metric Tons)	
1965				(8,981,000)*	7,347,000	
1966				9,076,000	7,274,000	
1967				8,550,000	7,182,000	
1968	8,789,000	5,524,000	3,265,000	10,136,000	8,098,000	
1969	8,435,000	4,903,000	3,532,000	8,157,000	6,962,000	
1970	10,745,000	5,247,000	5,317,000	10,507,000	8,724,000	
1971	10,093,000	4,432,000	5,661,000	10,804,000	8,619,000	Actual
1972	10,774,000	4,226,000	6,549,000	(11,340,000)	9,264,000	
1973	(11,341,000)	(4,476,000)	(6,813,000)	(12,610,000)	10,350,000	
1974				13,064,000	10,705,000	
1975				14,515,000	11,884,000	
1976				14,515,000	11,884,000	Projected
1977				14,878,000	12,156,000	
1978				16,148,000	13,245,000	
1979				16,148,000	13,245,000	
1980				20,140,000	16,511,000	
1981				20,503,000	16,783,000	
1982				20,503,000	16,783,000	
1983				20,865,000	17,055,000	
1984					17,327,000	
1985					19,051,000	

* Bracketed Figures are estimated

≠ Canadian consumption of Ontario iron ore is assumed to be by the three major Ontario steel companies, Algoma, Dofasco and Stelco. Similarly, the raw steel production given here is the total output of the same three major producers. (Electric furnace operations have been ignored as they consume negligable quantities of iron ore).

TABLE 17

PRODUCING MINES - ONTARIO

	Capacity Metric TPY	Metric Tons Shipped (In Millions) 1970	1971	1972	1973	Reserves (Years)
Geo. W. MacLeod (Algoma Steel Corp)	2.24	1.55	1.65	1.82	2.08	22
Moose Mount. (National Steel Corp)	0.69	0.67	0.69	0.68	0.71	8
Falls Bay (Caland Ore Co.)	2.3	2.18	1.49	1.88	2.12	To close in 1981
Steep Rock Iron Mines	1.42	1.51	1.44	1.49	1.44	16
Griffith Mine (Stelco)	1.52	1.53	1.39	1.46	1.54	30
Sherman Mine (Dofasco)	1.05	0.93	1.04	1.07	1.05	34
Adams Mine (Dofasco)	1.1	1.19	1.05	1.11	1.19	24
Marmoraton Mining Co. (Bethlehem Chile Iron Ore Co.)	0.55	0.47	0.48	0.47	0.49	6
INCO (Iron Ore Pellets)	0.82*	0.68	0.81	0.71	0.63	-
Falconbrige, Pellets	0	0.06	0.08	0.19	0	Closed Jan., 1973
Total	11.69	10.77	10.12	10.88	11.25	

* INCO's installed capacity is 0.82 million tons per year; production has been reduced for environmental reasons.

TABLE 18

CAPACITY PROJECTIONS FOR THE PRODUCING MINES: 1973-1981

CAPACITY (METRIC TONS) IN:

MINE	1975	1976	1977	1978	1979	1980	1981
G.W. McLeod	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000
Moose Mountain	690,000	690,000	690,000	690,000	690,000	690,000	690,000
Falls Bay (Caland)	2,200,000	1,950,000	1,600,000	1,600,000	1,600,000	1,100,000	742,000
Steep Rock	1,420,000	1,420,000	1,420,000	1,420,000	1,420,000	1,420,000	1,420,000
Griffith	1,520,000	1,520,000	1,520,000	1,520,000	1,520,000	1,520,000	1,520,000
Sherman	1,125,000	1,125,000	1,125,000	1,125,000	1,125,000	1,125,000	1,125,000
Adams	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
Marmoraton	490,000	490,000	490,000	490,000	NIL	NIL	NIL
INCO	710,000	710,000	710,000	710,000	710,000	710,000	710,000
Lake St. Joseph	-	-			4,000,000	4,000,000	4,000,000
TOTAL *	11,495,000	11,245,000	10,895,000	10,895,000	14,405,000	13,905,000	13,547,000
TOTAL **	11,495,000	11,245,000	10,895,000	10,895,000	10,405,000	9,905,000	9,547,000

* INCLUDING LAKE ST. JOSEPH

** NOT INCLUDING LAKE ST. JOSEPH

TABLE 19

IRON ORE RESOURCES OF ONTARIO[1]

RESERVES AND RESOURCES, MILLIONS OF METRIC TONS		MEAN IRON CONTENT	RANGE OF IRON CONTENT
		%	%
556		54	50-70
407		36	35-50
5,545		27	20-35
6,508	Mean	30%	

Source: R. Shklanka - "IRON ORE DEPOSITS OF ONTARIO", Mineral Resources Circular No. 11, Ontario Department of Mines, 1968.

TABLE 20

IRON ORE RESERVES WITH POTENTIAL FOR LARGE SCALE OPERATION

IN MILLIONS OF METRIC TONS

	RESERVES	CONDITIONAL MEASURED	RESOURCES INDICATED	HYPO-THETICAL RESOURCES	GRADE %	POTENTIAL CAPACITY FOR PRO-DUCTION MILLION MT
Lake St. Joseph Steep Rock Iron Mines Ltd.		626			23	3-10
Eagle Is. Lake St. Joseph Mines Ltd.			240		35	3-10
North Spirit Lake Optioned to Stelco by North Spirit Lake Syndicate			152	356	30	Not known
Skibi Lake, Anaconda Iron Ore (Ont) Ltd.		340			26.2	1.5-2
Errington Twp. (Geraldton) Algoma Steel Corp.		102	229		25	2.5-3
Sub Total		1,068	621	356		
TOTAL		2,045				

Sources: R. Shklanka -"Iron Ore Deposits Of Ontario". Mineral Resources Circular No. 11, Ontario Department of Mines 1968

TABLE 21

ORE RESERVES ≠ IN ONTARIO - PRODUCING MINES

MINES AND OPERATOR	IN MILLIONS OF METRIC TONS RESERVES	CONDITIONAL RESOURCES MEASURED	INDICATED	GRADE * %
C.W. McLeod Mine Algoma Steel Corp.	71			35
Moose Mount. Mine National Steel Corp.	20.3			30.3
Falls Bay Mine Caland Iron Ore Company	13.2			58
Steep Rock Iron Mines	16.3	7.2	72	55
Griffith Mine Stelco	16.3			25
Sherman Mine Dofasco	122			23
Adams Mine Dofasco	106			22
Marmoraton Mining Co.	7.3			28
TOTAL	372.4	7.2	72	

* The data available for Grade did not distinguish between Soluble, Magnetic, or total iron.

≠ See Appendix for definition of reserves, resources, etc.

TABLE 22

PRICES FOR HAMMERSLEY LUMP ORE (64% Fe)

1966-67	$10.08 U.S. Per Metric Ton
1968	9.52
1969	9.52
1970	9.73
1971	9.73
1972	NA.
1973	11.14

TABLE 23

AVERAGE LAKE ERIE BASE PRICES FOR IRON ORE

($ U.S. per metric ton)

	1964-9	1970	1971	1972	1973	1974
IRON ORE PELLETS*	15.36	16.22	17.07	17.74	17.92	21.64
DIRECT SHIPPING**	10.92	11.18	11.55	12.10	12.56	14.28

*51.5% Fe ** 60.0% Fe

TABLE 24

Financial Performance of Seven Iron Ore Mining Companies in Ontario 1973

Value of Goods Produced	$111,818,000
Operating Costs	98,866,000
Depreciation	10,453,000
Development & Preproduction expenses	3,839,000
Income Before Taxes	(1,340,000)
Taxes:	2,745,000
Net Profit (Loss) after Taxes	(4,095,000)
Shareholders Equity or Employed Capital	273,410,000
Annual Shipment of product	8,874,560 metric tons
Return on employed capital	(1.50%)
Net Profit (Loss) Margin	(3.66%)
Net Income per metric ton of product	($0.461/M.T.)

TABLE 25

IRON ORE TRANSPORTATION COSTS FROM QUEBEC TO WORLD MARKETS

From Quebec to:	Distance (Miles)	$/MT	Cost ¢/MT/Mile
Pittsburgh, Pa.	1020	6.45	0.633
Holland	2900	1.32	0.0460
Great Britain	2600	1.12	0.0430
Italy	4100	2.03	0.0500
Japan	11800	3.45	0.0293

Source: G.E. Aiken, J.M. Bertram, R.B. Greenwalt, "Streamlining th North American Taconite Industry." Mining Engineering, Oct. 1973

TABLE 26

WORLD DIRECT-IRON PLANT ANNUAL CAPACITY

Country	Annual Capacity Million Metric Tons
Brazil	0.27
Canada	0.71 + 2.0 in 1977 from Lake St. Joseph
Germany	0.47
Greece	0.25
Korea	0.15
Japan	0.01
Mexico	0.71 + 0.61 in 1974-1975
New Zealand	0.15
Republic of South Africa	0.76
Sweden	0.13
United States	1.20
Venezuela	1.01
TOTAL	5.82 or 6.43 in 1974-1975

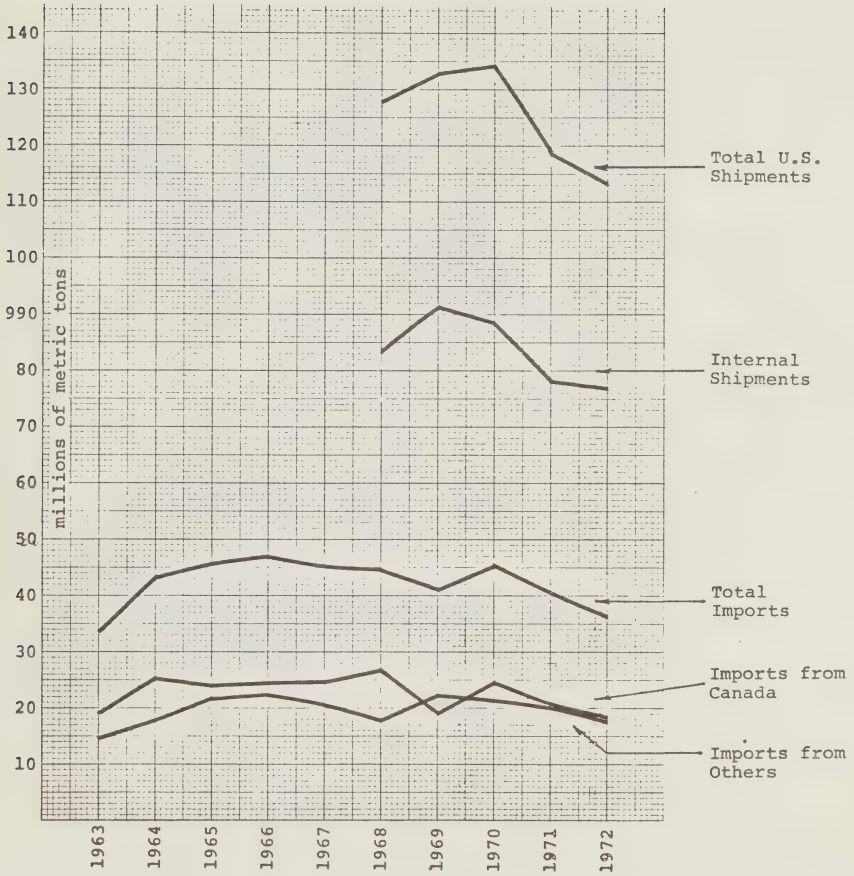
Source: World Iron Ore and Direct Iron Capacity. U.S. Dept. of Commerce, Feb. 1973.

FIGURES

Figure 1

World Iron Ore Movements.

Figure 2



U.S. Iron Ore Shipments.

Figure 3

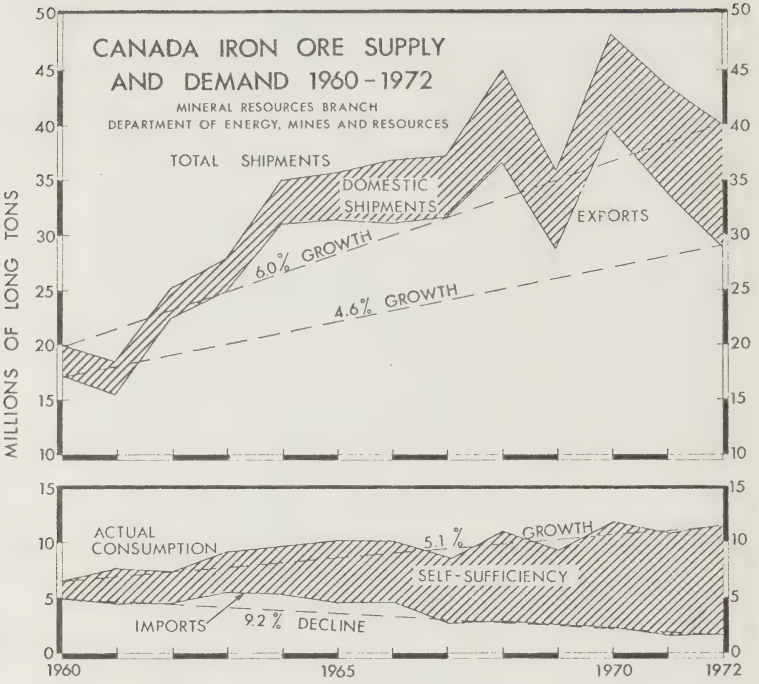
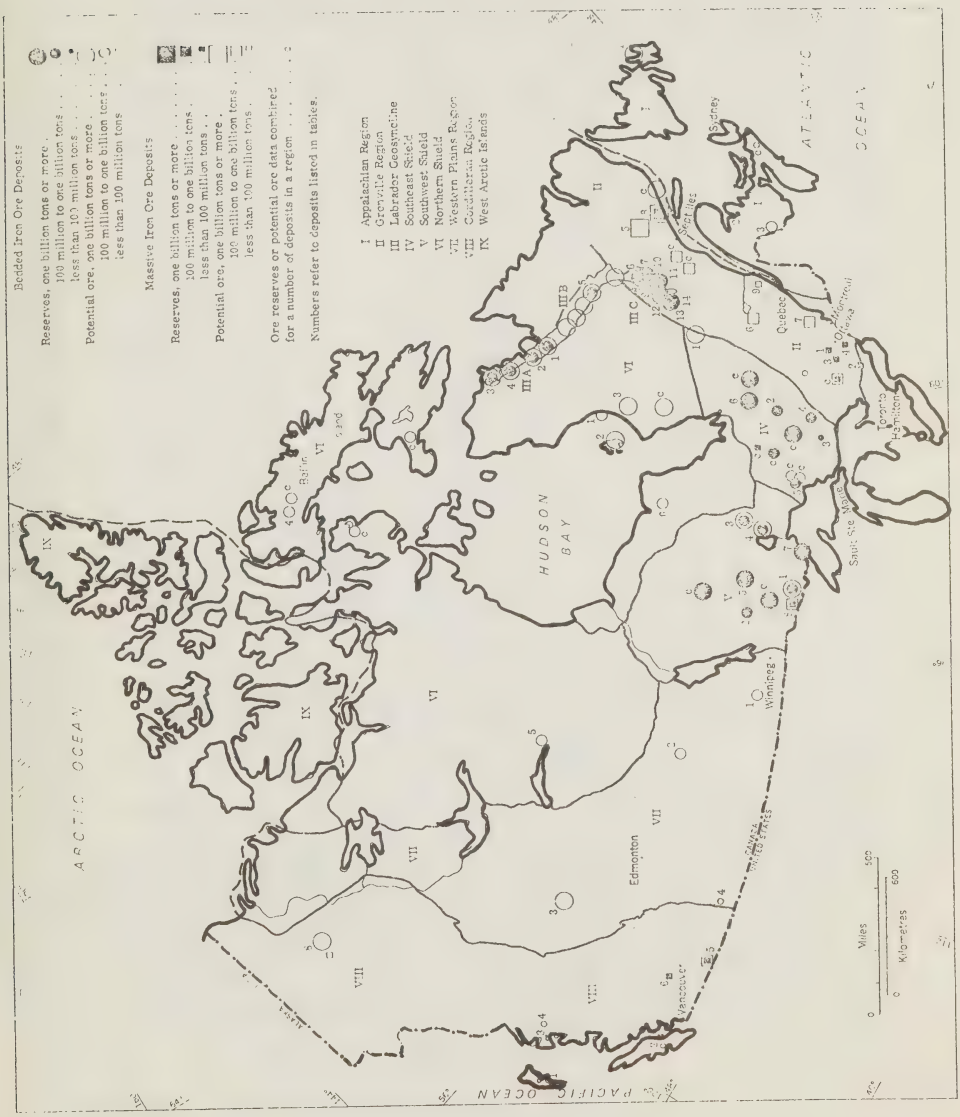

CANADA IRON ORE SUPPLY AND DEMAND 1960 - 1972
MINERAL RESOURCES BRANCH
DEPARTMENT OF ENERGY, MINES AND RESOURCES
MILLIONS OF LONG TONS
TOTAL SHIPMENTS
DOMESTIC SHIPMENTS
EXPORTS
6.0% GROWTH
4.6% GROWTH
ACTUAL CONSUMPTION
5.1 % GROWTH
SELF-SUFFICIENCY
IMPORTS
9.2 % DECLINE
1960
1965
1970
1972

Figure 4 Distribution of the Iron Ore Resources of Canada.



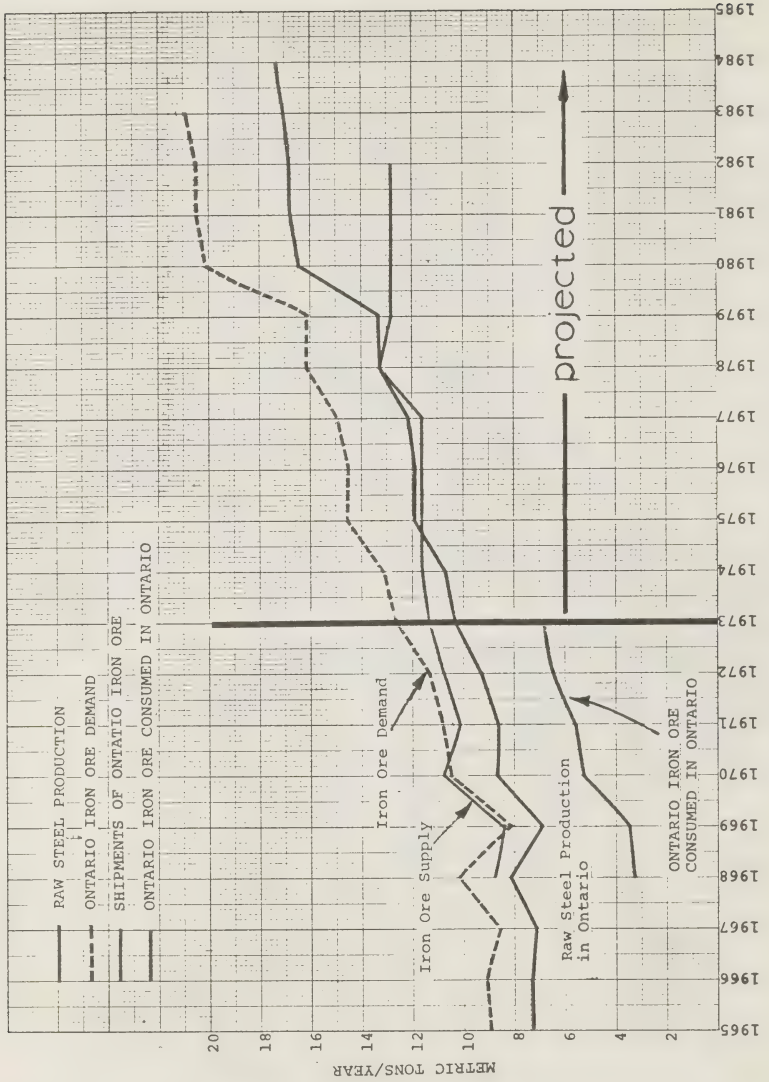


Figure 5 The Ontario Iron and Steel Industries

Figure 6

Ontario's Producing Iron Ore Mines. 1974

Figure 7 Metal Market Weekly Steel Scrap Price Composite.

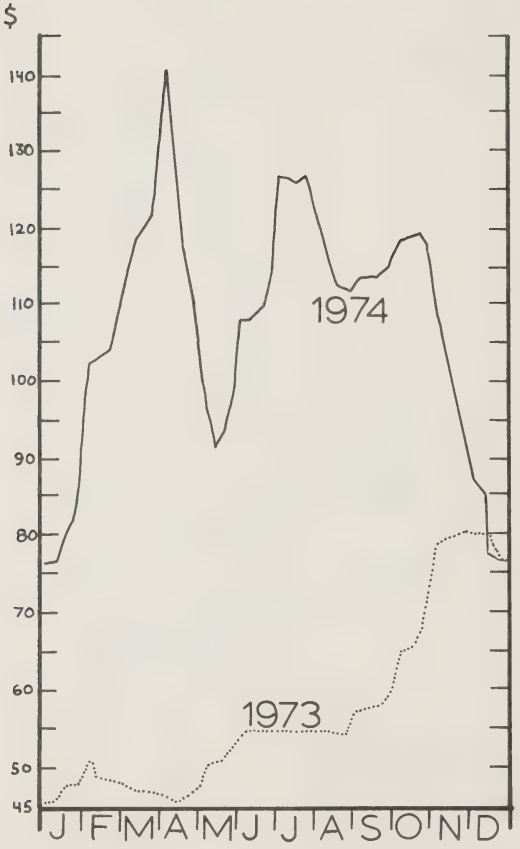
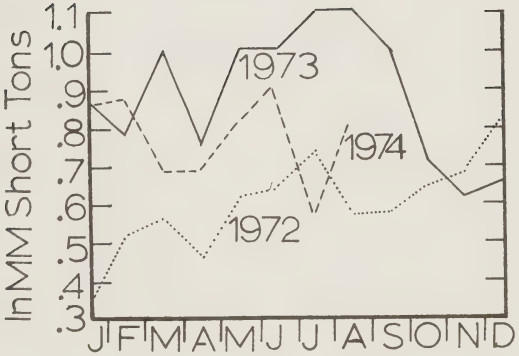


Figure 8 US Exports of Iron and Steel Scrap.



APPENDIX A

IRON ORE PROSPECTS OF ONTARIO

IRON ORE RESOURCES IN ONTARIO - PROSPECTS

	IN MILLIONS OF METRIC TONS			
PROSPECT AND OWNER	RESERVES	CONDITIONAL RESOURCES MEASURED	INDICATED	HYPOTHETICAL RESOURCES	GRADE** %
Goulais River Algoma Steel Corp.			75	75	30
Eagle & Fish Is. Lake St. Joseph Iron			240		35
Papaonga Lake Copper-Man Mines*				14	23
Kesaka Lake Tex-Sol Expln. Ltd.		117		203	31.2
Bending Lake Jalore Mining Co.			127		25
North Spirit Lake Upper Canada Resources			152	356	30
Cummings Lake Eagle Rock Iron Mines Limited				356	24
Emo, Great West Mining & Smelting Corp.			32	88	25
That Man Lake Lakehead Mines Ltd.			44	58	30
Newboro, Hymar Mining and Reduction Ltd.		54		20	26.7
North Kashaweogama Hanna Mining (Leasee)				81	28

* Claims on this property have lapsed

** A cut-off grade of 20% iron has been applied

IRON ORE RESOURCES IN ONTARIO - PROSPECTS

PROSPECT AND OWNER	RESERVES	IN MILLIONS OF METRIC TONS CONDITIONAL RESOURCES MEASURED	INDICATED	HYPOTHETICAL RESOURCES	GRADE** %
Skibi Lake Anaconda Iron Ore (Ont) Ltd.		340			26.2
Central Onaman Range, Algoma Steel (Leasee)		102	102		22.5
Stewart Lake Stewart Lake Iron Mines Ltd.		22	28		30
Summit Lake Steward Lake Iron Mines Ltd. *			7	34	30
Errington Twp. Algoma Steel Corp.		102	229		25
Kaministikwia				193	46.5
Matawin Iron Range Monpre Mining Co.				122	29.5
Boston Creek Marshal Boston Iron Mines Ltd.				56	30
Pivabiska Algoma Steel Corp.		31			25
Ogami Lake Massval Mines Ltd. *				102	21.6
Calabogie Algoma Steel Corp.			46		26
Burwash Lake Ironco Mining & Smelting Ltd.				102	20.7
Radio Hill Kukatush Mining		161			20.8

* Claims on this property have lapsed.

IRON ORE RESOURCES IN ONTARIO - PROSPECTS

	IN MILLIONS OF METRIC TONS			
PROSPECT AND OWNER	RESERVES	CONDITIONAL RESOURCES MEASURED	INDICATED	HYPOTHETICAL RESOURCES	GRADE** %
Doran Lake Little Long Lac & Lundor Mines		174			22.3
Lk. St. Joseph, Steep Rock Iron Mines, Ltd.		626			23
Sub Totals		1,729	1,082	2,368	
TOTAL TONNAGE			5,179		

APPENDIX B

Classification of Mineral Reserves and Resources

ONTARIO MINERAL INVENTORY

RESOURCE CLASSIFICATION

Feasibility of economic recovery within 25 years ⟶			⟵ Degree of Certainty			
			Discovered Resources		Undiscovered Resources	
			Known Deposits		Hypothetical (In Known Districts)	Speculative (In Unknown Districts)
			Proven / Measured	Probable / Indicated	Possible / Inferred	
	Economic		RESERVES 1 A Reasonably assured reserves/resources		2 A Estimated additional resources	3 A
	Sub-economic	Para-marginal	CONDITIONAL RESOURCES 1 B Reasonably assured resources. Mining feasibility > 50%		2 B Estimated additional resources. Mining feasibility > 50%	3 B
		Sub-marginal	CONDITIONAL RESOURCES 1 C Reasonably assured resources. Mining feasibility 10-50%		2 C Estimated addtional resources. Mining feasibility 10-50%	3 C

For the purpose of the classification, a Resource is defined as "a concentration of naturally occurring solid, liquid, or gaseous materials in or on the earth's crust in such form that economic extraction of a commodity is currently or potentially feasible."

Resources are sub-divided into three groups:

a) Discovered Resources

Discovered resources are specific bodies of mineral bearing material whose location, quality and quantity are known from geological evidence supported by engineering measurements. These resources are composed of proven and probable reserves plus conditional resources.

i) Proven Reserves

Proven ore is that material for which tonnage is computed from dimensions revealed in outcrops or trenches or underground workings and/or drill holes and for which the grade is co-puted from the results of adequate sampling. The sites for inspections, sampling and measurement are so spaced and the geological character so well defined that the size, shape, and mineral content are established. The computed tonnage and grade are judged to be accurate within limits which must be stated. It must be stated whether the tonnage and grade of "proven" ore is in situ or extractable, with dilution factors shown, and reasons for the use of these dilution factors clearly explained.

The above definition is that approved for use in submissions to the Ontario Securities Commission. Calculated tonnages and grades are required to be accurate to within twenty percent. Proven ore may be taken as being the same as "measured ore" as the term is defined by the United States Bureau of Mines.

ii) Probable Reserves

Probable ore is that material for which tonnage and grade are computed partly from specific measurements, samples, or production data, and partly from projecting for a reasonable distance on geologic evidence. The sites available for inspection, measurement, and sampling are too widely or otherwise inappropriately spaced to outline the material completely or to establish its grade throughout.

Probable ore may be taken as being the same as "indicated ore" as defined by the United States Bureau of Mines.

For purposes such as feasibility studies, summation of tons and grade of proven and probable ore reserves may be acceptable if it is stated that they are combined.

iii) Conditional Resources - Para Marginal

Para marginal conditional resources are discovered resources not at present economically mineable but which are expected to become wo within the next 25 years with a likelihood of more than 50%.

The time span and probability factors may vary from case to case and must be stated. It must be noted that the definition refers to deposits which will become economically mineable. This does not necessarily mean that they will actually be mined within the stated time span.

iv) Conditional Resources - Sub Marginal

Sub-marginal conditional resources are discovered resources not at present economically mineable but which may become so within the next 25 years. The likelihood is, however, less than 50% although more than 10%.

b) Hypothetical Resources

Hypothetical resources are undiscovered materials that may reasonably be expected to exist in known mining districts under known geological conditions.

Exploration that confirms the existence of hypothetical resources, and reveals quantity and quality, will permit their reclassification as proven or probable reserves or conditional resources.

Hypothetical resources may be classified into economic, para-marginal, and sub-marginal categories in the same way as discovered resources.

A special case of economic hypothetical resources are Possible Reserves which are defined as follows:

"Possible ore is that material for which quantitative estimates are based largely on broad knowledge of the geologic character of the deposit and for which there are few, if any, samples or measurements. The estimates are based on an assumed continuity or repetition for

APPENDIX C

Iron Ore Mining Legislation in Ontario, An Historical Perspective

which there are reasonable geological indications; these indications may include comparison with deposits of similar type. Bodies that are completely concealed may be included if there is specific evidence of their presence."

Possible ore is similar to "inferred ore" as defined by the U.S. Bureau of Mines although, to most geologists, "inferred" is a considerably broader term than "possible".

The inclusion of possible ore in ore reserves for the purposes of cost and feasibility studies is not acceptable.

c) Speculative Resources

Speculative resources are undiscovered materials that may occur in known types of deposit in a favourable geological setting where no discoveries have yet been made or in as yet unknown types of deposit that remain to be recognized.

Exploration that confirms the existence of speculative resources and reveals quantity and quality will permit their reclassification as proven or probable reserves or conditional resources.

Speculative resources may be classified into economic, para-marginal, and sub-marginal categories in the same way as discovered resources. This exercise has, however, limited practical value.

IRON ORE MINING LEGISLATION IN ONTARIO, AN HISTORICAL PERSPECTIVE

The earliest legislation to promote iron ore mining and smelting was passed in 1883. The federal Act to Encourage the Manufacture of Pig Iron in Canada from Canadian Ore provided $1.50 per ton of pig iron as a bounty, and was effective until 1889.

In 1894 and 1904, the Iron Ore Mining Fund in Ontario paid $1.00 per net tons of pig iron smelted in Ontario from Ontario ore.

A variety of Federal Acts were passed over the years 1894 to 1907 which provided bounties for iron and steel produced in Canada from Canadian ores, but in spite of this there was no real development of an iron ore industry.

In 1907, Ontario's Mining Tax Act provided for the remission of mining tax on profits from the mining of iron ores which were smelted in Canada.

In 1924 Ontario passed the Iron Ore Bounty Act which provided a bounty of ½¢ per metallic iron unit for ore mined in Ontario and processed to pig iron or steel in Ontario. This Act also removed the restriction on patents for Ontario mining lands requiring all ore mined to be refined in Canada.

In 1930, the 1924 Act was repealed, and a new Act passed which had the same provisions as the old Act, but the bounty on iron ore was increased to a rate of 1¢ per metallic iron unit.

In 1936, the Federal government established the 3-year tax holiday for new mines and in 1937 Ontario increased the bounty of 2¢ per iron unit, and made it payable when the ore was shipped. The bounty was discontinued in 1942, even though the Act was effective until 1949.

In 1949, the Federal government established depletion allowance as a percent of profits and removed ministerial discretion in this respect.

In 1970, iron ore lost its statutory exemption from the "further processing" section of the Mining Act.

In 1972, the Mining Tax Act of Ontario was amended repealing the remission of mining tax on profit from ore smeltered in Canada.

In 1973, the Federal Tax laws repealed the 3 year tax free holiday on new mines.